THE MANUFACTURE OF ELECTRONIC EMITTERS USING MODIFIED PHOTOSENSITIVE RESIN

Daniel Burda[1,2,+], *Stanislav Stříteský*[3], *Mathias Bartl*[4], *Jan Sobków*[5], *Michal Krysztof*[5], *Rupert Schreiner*[4], *Milan Matějka*[1,3], *Alexandr Knápek*[1]

[1] Institute of Scientific Instruments of the Czech Academy of Sciences, Královopolská 147, 612 64 Brno, Czech Republic
[2] Faculty of Electrical Engineering and Communication, Brno University of Technology, Technická 3058/10, 616 00 Brno, Czech Republic
[3] IQS nano s.r.o., A1 Park, Hall F2, Hlavní 110, 664 31 Lelekovice, Czech Republic
[4] Faculty of Applied Natural Sciences and Cultural Studies, OTH Regensburg, D-93053 Regensburg, Germany
[5] Faculty of Electronics, Photonics and Microsystems, Wrocław University of Science and Technology, 11/17 Janiszewskiego St., 50-372 Wrocław, Poland
daniel.burda@isibrno.cz

ABSTRACT

This study presents the experimental fabrication of electron emitters. The process involves two main steps. First, a two-photon lithography (2PL) system (IQnano3D, IQS nano) is employed to print the base structure along with the electrodes using a photosensitive resin (ResIQ, IQS nano). The resulting printed structures typically reach a height of approximately 50 µm. In the second step, these cured resin base structures undergo thermal treatment. This treatment transforms the surface of the resin into a conductive layer through heat-induced modification. The conductive layer may also be created via electroless plating or metal evaporation.

Each chip is fabricated on a square silicon substrate with dimensions of 10 × 10 mm, upon which the modified structures are formed. The emitter geometry is kept simple and the shapes have increased base area to provide good adhesion to the silicon substrate. Chips containing the conductive features were individually evaluated for outgassing in an ultra-high-vacuum chamber (~10^{-7} Pa) [1].

These chips are intended for testing and integration into low-energy electron optical systems, such as [2], with the aim of developing compact electron-emitting devices.

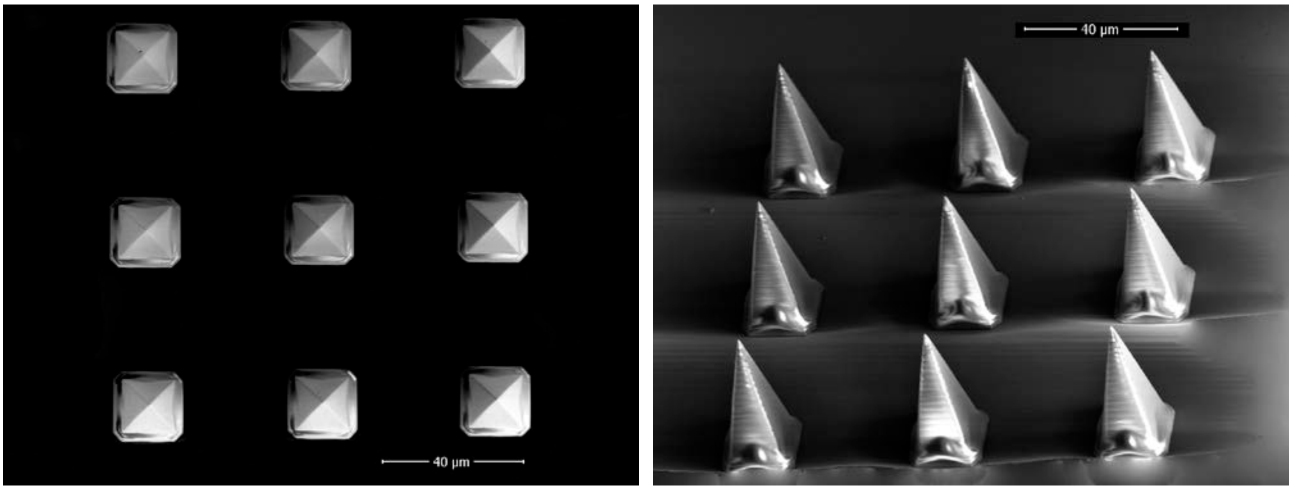

Fig. 1. a) SEM image of a pyramid-like array of fabricated resin-based emitter structures, left: top view, right: side view tilted by 30 degrees.

References

[1] A. Knapek, M. Horacek, F. Hruby, J. Sikula, T. Kuparowitz, and D. Sobola, “Noise behaviour of field emission cathode based on lead pencil graphite”, 2017 30th International Vacuum Nanoelectronics Conference (IVNC), 274-275 (2017).

[2] T. Grzebyk, P. Szyszka, M. Krysztof, P. Urbański, M. Białas, J. Jendryka, J. Sobków, M. Zychla, P. Knapkiewicz, and J. Dziuban, “MEMS-based Vacuum Nanoelectronic Instruments”, 2025 38th International Vacuum Nanoelectronics Conference (IVNC), 1-2 (2025).